TRANSLATION

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Form PCT/IPEA/416
B14347.3 SL		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/FR2004/050483	05.10.2004	06.10.2003

International Patent Classification (IPC) or national classification and IPC

G21C3/62

Applicant

COMMISSARIAT A L'ENERGIE ATOMIQUE

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 9 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

   a. ☐ *(sent to the applicant and to the International Bureau)* a total of _____ sheets, as follows:

      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s))

      _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
Name and mailing address of the IPEA/EP	Authorized officer
Facsimile No.	Telephone No.

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on translations from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

☐ international search (Rule 12.3 and 23.1(b))

☐ publication of the international application (Rule 12.4)

☐ international preliminary examination (Rule 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1-32 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

nos. 1-17 as originally filed/furnished

nos.* _____ as amended (together with any statement) under Article 19

nos.* _____ received by this Authority on _____

nos.* _____ received by this Authority on _____

☒ the drawings:

sheets 1/2,2/2 as originally filed/furnished

sheets* _____ received by this Authority on _____

sheets* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-17	YES
	Claims		NO
Inventive step (IS)	Claims	4-7, 9	YES
	Claims	1-3, 8, 10-17	NO
Industrial applicability (IA)	Claims	1-17	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Reference is made to the following documents:

D1: FR-A1-2 738 076;
D2: WO-A1-00/49621.

1. The present application does not fulfil the requirements set forth in PCT Article 33(1) because the subject matter of claim 1 does not involve an inventive step as defined in PCT Article 33(3).

1.1 Document D1, which is considered to be the prior art closest to the subject matter of claim 1, describes (see page 5, line 1 to page 6, line 15; the references between parentheses apply to said document):

- a method for producing nuclear fuel pellets based on uranium and plutonium mixed oxides and having a specific plutonium content, which method includes the following steps:

(a) preparing, by means of combined milling, a primary mixture of powders having a

plutonium content higher than said specific plutonium content (page 5, steps (a) and (b));

(b) sieving the milled mixture (page 5, step (c));

(c) preparing a final mixture of powders having said specific plutonium content by mixing the sieved material with a UO_2 powder (page 5, step (d));

(d) pelleting (page 5, step (e));

(e) sintering (page 5, step (e)); and

(f) during step (a), adding an organic sulphur-containing material.

1.2 The subject matter of claim 1 differs from this known production method in that at least one compound selected from chromium, aluminium, titanium, vanadium, magnesium and niobium oxides (and the precursors thereof) or inorganic sulphur-containing compounds is added to the primary mixture during step (a).

1.3 The problem that the present invention is intended to solve can be considered to be that of reducing, in pellets produced using a MIMAS-type production method, the release of fission gases from the uranium/plutonium mixed oxide fuel pellets (MOX pellets) caused by the non-uniform distribution of $(U/Pu)O_2$ clusters within the UO_2 matrix (see the description, page 8, lines 17-25).

1.4 The solution proposed by the present invention is

to include a specific oxide or an inorganic sulphur-containing compound in the primary powder mixture.

1.5 The solution proposed in claim 1 of the present application is not considered to be inventive under the terms of PCT Article 33(3), for the following reasons:

The addition of specific oxides or inorganic sulphur compounds increases the density distribution of plutonium (or thorium) as well as the grain size thereof (see the description, page 11, lines 13-19) and this is conducive to the retention of fission gas.

It is, however, routine practice to add oxides, in particular, chromium, aluminium, magnesium, titanium, niobium and vanadium oxides, to the uranium/plutonium or uranium/thorium oxide mixture during the production of MOX fuels, as is recognised by the applicant (see the description, page 10, line 25 to page 11, line 3). Document D2, in particular, describes (see the whole document) the addition of the aforementioned oxides to the primary mixture in order to produce a fuel that has a larger grain size and is thus capable of increasing fission gas retention.

On the basis of the production method in document D1, it would, therefore, be obvious for a person skilled in the art seeking to solve the

aforementioned problem to add oxides, as described in document D2, with a corresponding effect and thereby arrive at a production method as per claim 1.

2. Dependent claims 2 and 3 do not contain any features which, in combination with the features of any one of the claims to which they refer, might define subject matter that fulfils the PCT requirement of inventive step, for the following reasons:
The features disclosed in claims 2 and 3 are described in D2.

3. Dependent claims 8 and 10-16 do not contain any features which, in combination with the features of any one of the claims to which they refer, might define subject matter that fulfils the PCT requirement of inventive step, for the following reasons:
The features disclosed in claims 8 and 10-16 are described in D1.

4. Independent claim 17 relates to a nuclear fuel pellet produced in accordance with the method in claim 1.
It follows that the subject matter of claim 17 is not inventive.

5. The combination of features in dependent claims 4-7 and 9 is not found in the prior art and cannot be derived in an obvious manner therefrom, for the

following reasons:

None of the prior art documents suggests the addition of an inorganic sulphur-containing compound to the primary mixture of uranium/plutonium (or uranium/thorium) oxides.

6. The present examiner acknowledges that examples 1-5 in the application demonstrate that the addition of chromium to the pellets leads to a substantial increase in grain size during the plutonium (or thorium) phase compared with the grain size during the uranium phase.

This effect does not, however, appear to be the main aim of the invention. According to the description (see page 6, lines 20-29 and page 8, lines 17-25), the invention is merely intended to enhance the distribution of plutonium clusters within the UO_2 matrix and thereby reduce the release of fission gases. Similarly, in the preamble of claim 1, the aim is merely to produce nuclear fuel pellets containing mixed oxides and *"... having a specific plutonium or thorium content"* and no reference is made to the grain size.

Upon reading D2, which achieves the same result of reducing the release of fission gases by increasing the grain size of the fuel by adding Cr_2O_3, a person skilled in the art would have no need whatsoever to compare the differential grain size growth during the plutonium phase with that

Box No. V — Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

during the uranium phase in order to use the teaching of said document D2, with a corresponding effect, in the method of D1 and thereby arrive at the production method as per claim 1.

It follows that, in light of D2, the objection with respect to the inventive step of claim 1 could apparently be dispelled during a national or regional phase if claim 1 were worded differently, for example "... having a specific plutonium or thorium content *and a mean grain size during the plutonium or thorium phase that is greater than that during the uranium phase*, which method includes ..."

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made: